

Inventory of *Doing What Works* (dww.ed.gov) Professional Development Materials

Topic: *Encouraging Girls in Math and Science (GMS)*

| TOPIC SUMMARY | | |
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| Title/Media Type | Who | Description |
| <i>Encouraging Girls in Math and Science</i> Multimedia Overview 6:46 min | | <ul style="list-style-type: none"> This overview presents five research-based instructional and feedback strategies for teachers at all grade levels for encouraging girls in math and science. Women are less involved in career paths and postsecondary education in some areas of math and science than men. This pattern starts in school. |
| <i>Encouraging Girls in Math and Science</i> Visual Diagram | | This is a graphical overview of the 5 interrelated research-based practices that aim to increase academic self-esteem, interest, and achievement in math and science. Gathered around a supportive and encouraging teacher, the girls in this diagram show high confidence that they can succeed in math and science as students and as professionals. |
| <i>Encouraging Girls in Math and Science (Part 1)</i> Expert Interview 11:31 min | Diane Halpern, Ph.D. Claremont McKenna College | <ul style="list-style-type: none"> Dr. Halpern describes the research evidence and reasoning for the 5 practices in the Practice Guide. Students should be told that abilities are expandable. Giving students specific feedback lets them know what they need to focus on to advance. Role models are effective because they send girls the message that “someone like me can do this.” Live experimentation in the classroom helps spark students’ interest and connects math and science to their everyday lives. Girls, and students in general, can also benefit considerably from training in visual spatial skills. |
| <i>Encouraging Girls in Math and Science (Part 2)</i> Expert Interview 4:11 min | Diane Halpern, Ph.D. Claremont McKenna College | <ul style="list-style-type: none"> Dr. Halpern discusses implementation ideas and roles that school staff, district administrators, and parents can play to encourage girls in math and science. Learning happens outside of the classroom, too. A communitywide message helps support teachers in their role. Parents can also help reinforce the message that girls belong in the math and science fields. School leadership makes a difference. Having principals, superintendents, boards of education, and parent groups on board sends a message to students that this is a priority. |

Topic: *Encouraging Girls in Math and Science (GMS)***Practice:** *Teach students that the brain grows when they practice and learn new material. (Ability Is Expandable)***PRACTICE SUMMARY**

| Title/Media Type | Description |
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| <i>Ability Is Expandable</i> Multimedia Overview 7:32 min | <ul style="list-style-type: none">• There are two ways to view intelligence: that it is “fixed” and can’t be changed, or that it is “expandable” and that with effort abilities can improve or expand.• Combining the fixed mindset with gender stereotypes can be particularly harmful for girls, who are frequently exposed to the idea that they are not supposed to be good at math.• Students with the expandable mindset are more likely to take on challenges, explore new concepts, enroll in advanced courses, and join a math or science club.• Students’ beliefs about their abilities are reinforced through social interactions. Teachers are in a powerful position to help.• When students get frustrated, they need to be reminded that improvement just takes effort. When they do well, they need to understand that it is the result of their effort. |

LEARN WHAT WORKS

| Title/Media Type | Who | Description |
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| <i>The Growth Mindset (Part 1)</i> Expert Interview 9:07 min | Carol Dweck, Ph.D. Stanford University | <ul style="list-style-type: none">• Dr. Dweck explains the “growth” vs. “fixed” mindset and implications for girls learning math and science.• Students with a fixed mindset have performance-oriented goals: they want to do things they’re good at. Students with a growth mindset have learning goals: they want challenging tasks, and don’t worry about making mistakes.• When students are taught the “growth mindset” model, they are more motivated and perform better. This is especially true for girls in mathematics, who face negative stereotypes about their inherent math ability. |
| <i>The Growth Mindset (Part 2)</i> Expert Interview 5:35 min | Carol Dweck, Ph.D. Stanford University | <ul style="list-style-type: none">• Dr. Dweck describes how teachers can help girls develop a “growth” mindset.• Teachers should help students understand that tests only measure their current skill level—not their potential.• Students react well to putting this issue in terms of how the brain works—that their brain forms new connections every time they struggle and work hard. |

| SEE HOW IT WORKS | | | |
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| Title/Media Type | Who | Description | Sample Material |
| <i>Helping Students Learn From Mistakes</i> Audio Interview 7:27 min | Deborah Kerschner Green Valley Elementary School Sinking Spring, PA | <ul style="list-style-type: none"> An elementary math teacher describes school-wide efforts to teach students that they can expand their abilities through hard work. Teachers started focusing on teaching a growth mindset (and rewarding mistakes), and big changes started being visible in students 2–4 months into the school year: students became more willing to volunteer answers and see mistakes as a learning opportunity. | <i>Two Mindsets</i> —A visual aid to remind students of the 2 mindsets they can follow. The chart contrasts the fixed and growth mindsets with respect to the way students respond to challenge, success, failure, and criticism. |
| <i>Instilling Confidence</i> Video Interview 4:46 min | Kimberly Robinson Hillcrest High School Dallas, TX | <ul style="list-style-type: none"> A high school associate principal discusses strategies to encourage girls in science. Teachers should start by giving girls confidence in their ability to do the class work. Teachers must be honest with themselves about biases they have regarding gender stereotypes and address these before focusing on the students. | No Sample Material |
| <i>Grow Your Own Brain</i> Video 7:45 min | <i>Changing Your Mind</i> , from PBS's Scientific American Frontiers | <ul style="list-style-type: none"> This video discusses new research evidence demonstrating that mature brains can grow new brain cells and brain connections. | No Sample Material |
| | Green Valley Elementary School Sinking Spring, PA | | <i>Classroom Reading: You Can Grow Your Intelligence</i> —Teachers use this article on brain development for text discussions in small groups. Students read this article and discuss the research findings. |

| DO WHAT WORKS | |
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| Tool | Description |
| <i>Learning Together About Academic Abilities, Part 1</i> | An in-service tool that shows teachers how to help students develop accurate and positive perceptions of their math and science abilities. |
| <i>Learning Together About Academic Abilities, Part 2</i> | An in-service tool that shows teachers how to teach students that abilities are expandable. |
| <i>Teacher Self-Reflection: Teach Ability Is Expandable</i> | A self-reflection worksheet to guide teachers' understanding of messages and instructional strategies that may affect students' beliefs about their abilities in math and science. |
| <i>Teaching About Brain Plasticity</i> | Classroom activities to teach students about the brain's ability to grow in response to enrichment and practice activities. |
| Planning Templates | Comprehensive planning templates for working with state education agencies, districts, and schools on teaching that ability is expandable. |

Topic: *Encouraging Girls in Math and Science (GMS)*

Practice: *Provide prescriptive, informational feedback on strategies and effort. (Prescriptive Feedback)*

PRACTICE SUMMARY

| Title/Media Type | Description |
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| <i>Prescriptive Feedback</i> Multimedia Overview 7:47 min | <ul style="list-style-type: none">• This overview defines “prescriptive, informational feedback” and provides guidelines to teachers on how they can provide that type of feedback and the effect it can have on their students.• Teacher feedback can powerfully affect how students view their abilities—sometimes not in the way intended.• Teachers should focus on the learning process rather than the outcome. They should encourage making mistakes as part of the learning process as well.• Students who focus on performance goals avoid things that involve risk of failure or of looking less smart. |

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| Title/Media Type | Who | Description |
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| <i>The Nature of Prescriptive Feedback (Part 1)</i> Expert Interview 6:06 min | Carol Dweck, Ph.D. Stanford University | <ul style="list-style-type: none">• Dr. Dweck describes student motivation and performance and its implications for encouraging girls in math and science.• Students praised for their intelligence and ability did not want to take on challenging tasks and struggled when the difficulty of tasks increased. Students praised for working hard wanted more challenges and remained confident and interested (and performed better) as difficulty increased.• Students praised for intelligence were more likely to lie about their performance, indicating that praise had emphasized the importance of being smart so much that the children struggled to admit to mistakes.• Even the brightest girls often feel they have to be perfect all the time. Teachers should emphasize the academic process girls are engaged in, not the outcome or the girls’ performance. |

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| Title/Media Type | Who | Description |
| <i>The Nature of Prescriptive Feedback (Part 2)</i> Expert Interview 6:13 min | Carol Dweck, Ph.D. Stanford University | <ul style="list-style-type: none"> • Dr. Dweck describes how prescriptive, informational feedback might be used. • It is important that teachers not tell girls how smart or talented they are—they instead need to teach them how to address challenges and obstacles. • Train students to be able to receive feedback as a tool for learning. |

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| Title/Media Type | Who | Description | Sample Material |
| <i>Providing Positive Feedback in Elementary Math</i> Slideshow w/ audio (7 slides) | Joanne Anderson Don Pedro Elementary Ceres, CA | <ul style="list-style-type: none"> • A 6th-grade math teacher uses techniques to gauge students' understanding and level of self-confidence before providing them with informational feedback. • Students are taught to see mistakes as learning opportunities. • Students are praised for their effort—the focus is on the process rather than the final answer. • When common problems are identified, the teacher provides the class with prescriptive feedback geared to highlight the key steps involved in solving the problem. | No Sample Material |
| <i>Encouraging Effort Through Feedback</i> Audio Interview 5:16 min | Joanne Anderson Don Pedro Elementary Ceres, CA | <ul style="list-style-type: none"> • A 6th-grade math teacher describes how she praises students & corrects misunderstandings. Students are encouraged to focus on the process of math learning. • One student has learned that asking questions helps her understand the lesson better, and now asks frequent questions that benefit the whole class. | <i>Written Feedback on Classwork in Elementary Math</i> —A 6th-grade student worksheet completed after a math lesson. The teacher provides written feedback to provide students with praise on specific problem-solving strategies and guidance on correcting misunderstandings. |

SEE HOW IT WORKS

| Title/Media Type | Who | Description | Sample Material |
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| | Don Pedro Elementary Ceres, CA | | <i>Observing Feedback in a Math Classroom</i> —A checklist of strategies for classroom organization, feedback processes, and checking for students' understanding integrated into a math class. |

DO WHAT WORKS

| Tool | Description |
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| <i>Learning Together About Prescriptive Feedback</i> | This tool can be used in a teacher in-service session to teach them the difference between learning and performance goals, and to show them how to provide prescriptive, informational feedback. |
| <i>Observing Students to Develop a Feedback Plan</i> | A tool for pairs of teachers to guide observations of each others' classes with the end goal of improving the feedback given to students. |
| <i>Teacher Self-Reflection: Prescriptive, Informational Feedback</i> | A self-reflection checklist used by teachers to examine their current practices in providing students with prescriptive feedback and identify areas of improvement. |
| Planning Templates | Comprehensive planning templates for working with state education agencies, districts, and schools on teaching about prescriptive feedback. |

Topic: *Encouraging Girls in Math and Science (GMS)*

Practice: *Show students female role models to counter gender stereotypes. (Female Role Models)*

PRACTICE SUMMARY

| Title/Media Type | Description |
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| <i>Female Role Models in Math and Science</i> Multimedia Overview 6:50 min | <ul style="list-style-type: none"> • Role models are vital to offsetting the effects of stereotype threat—especially in math and science. • Teachers can expose girls to female role models by inviting them as guest speakers, arranging field trips to see them in the workplace, and encouraging students to participate in after-school activities and special events where role models are present. • In using role models, teachers should emphasize that everyone struggles, even the role models, and should highlight common ground and shared experiences between the role models and students. • Teachers themselves are role models and need to send the message that boys and girls are equals in math and science. |

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| Title/Media Type | Who | Description |
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| <i>Stereotype Threat (Part 1)</i> Expert Interview 6:46 min | Joshua Aronson, Ph.D. New York University | <ul style="list-style-type: none"> • Dr. Aronson describes what stereotype threat is and how it can impact academic achievement. • “Stereotype threat” is the fear of confirming a negative stereotype about one’s own group. • Children are aware at an early age that boys are “supposed” to be better at math than girls. Girls start out being as good at math as boys, but by middle school, stereotype threat becomes an issue and girls’ performance on math assessments suffers. • This perception causes problems when girls get old enough to start making choices—what classes they want to take, what field they want to major in. Fewer girls end up in the science and math “pipelines.” |
| <i>Stereotype Threat (Part 2)</i> Expert Interview 6:54 min | Joshua Aronson, Ph.D. New York University | <ul style="list-style-type: none"> • Dr. Aronson describes how to reduce stereotype threat by introducing students to role models and emphasizing gender similarities, rather than gender differences. • Using role models—people who have overcome the odds and done well in math and science—is one of the best ways to combat stereotype threat. Role models can convey the message that having difficulty is normal. • Trying to confront the stereotype head on by denying it and talking students out of it often does not work; it is better not to focus on gender differences at all. • Making the curriculum fun and engaging is essential for success. |

| SEE HOW IT WORKS | | | |
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| Title/Media Type | Who | Description | Sample Material |
| <i>Schoolwide Support for Girls</i> Audio Interview 3:49 min | Hal Strain Clarke N. Johnsen Junior High School Tooele, UT | <ul style="list-style-type: none">• A junior high school principal describes how the school's science teachers serve as role models.• Teachers connect students w/ science through real-world applications and bringing in guest speakers.• Discussions around role models and career aspirations are encouraged. | No Sample Material |
| <i>Female Role Models in Junior High</i> Video Interview 5:31 min | Cheryl Dearing Clarke N. Johnsen Junior High School Tooele, UT | <ul style="list-style-type: none">• A junior high science teacher discusses the school's programs that emphasize female role models.• Tutors, mentors, and guest speakers are part of the programs to encourage girls in math and science.• Girls attend conferences to hear female role models and learn about science & math careers. | No Sample Material |
| <i>Female Role Models in High School</i> Video Interview 6:50 min | Daniel Brown Hillcrest High School Dallas, TX | <ul style="list-style-type: none">• A high school physics teacher talks about guest speakers who present about their careers.• Female and minority speakers are young and "cool" and can better relate to students. | No Sample Material |
| <i>The Importance of Female Role Models</i> Video Interview 7:08 min | Nona Reimer John Malcom Elementary School Laguna Niguel, CA | <ul style="list-style-type: none">• A 5th-grade teacher and expert panel member shares experiences in teaching about female role models in math and science.• Exposure to positive role models can offset negative stereotypes that girls have about themselves.• After-school clubs that focus on math, science, and related careers can expose students to role models. | No Sample Material |



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| | No Site | | <i>Students' Essays: I Want to Be Like Her</i> —5 middle and high school student essays written for the “I Want to Be Like Her” competition. |
| | Hillcrest High School Dallas, TX | | <i>She Did It, You Can, Too</i> —A series of high school motivational posters introducing former students in the district who have been successful in their higher education and career paths. |

| DO WHAT WORKS | |
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| Tool | Description |
| <i>Learning Together About Female Role Models</i> | An in-service protocol to teach strategies for exposing girls to female role models who have achieved success in math or science. |
| <i>Planning for Implementation: Female Role Models</i> | A planning tool to guide the implementation of activities that will expose students to female role models in math and science. |
| <i>Teacher Self-Reflection: Teaching About Female Role Models</i> | A teachers' self-reflection form used to evaluate their instructional strategies for exposing girls to female role models who have succeeded in math or science. |
| Planning Templates | Comprehensive planning templates for working with state education agencies, districts, and schools on teaching about female role models. |

Topic: *Encouraging Girls in Math and Science (GMS)*

Practice: *Spark initial curiosity and foster long-term interest in math and science. (Sparking Curiosity)*

PRACTICE SUMMARY

| Title/Media Type | Description |
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| <p><i>Sparking Girls' Interest in Math and Science</i></p> <p>Multimedia Overview</p> <p>6:40 min</p> | <ul style="list-style-type: none"> • Explanation of what situational interest is and how it might transform into a long-term interest. • Strategies designed to capture girls' interest in math and science courses are discussed. The more interested students are in a subject, the more engaged they will become in their assignments and to seek learning opportunities outside the classroom. • Experiences can involve putting the material into a meaningful and relevant context, explaining why a concept is important in the real world, and using hands-on projects. • Talking about career opportunities in math and science can develop student interest, as can sharing examples of women working in male-dominated professions. |

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| Title/Media Type | Who | Description |
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| <p><i>Instructional Methods That Spark Curiosity (Part 1)</i></p> <p>Expert Interview</p> <p>7:40 min</p> | <p>Jon R. Star, Ph.D. Harvard University</p> | <ul style="list-style-type: none"> • Dr. Star discusses interest as a development process. Interest (e.g., student interest in a field) is viewed along a continuum, from short-term (situational) to long-term (individual). • Students start with something that sparks their initial curiosity, and gradually move toward long-term interest if the curiosity is nurtured and supported over time. • Teachers can affect this process by supporting the initial, situational interest w/ a variety of techniques. • Research shows a link between interest and both academic performance and later outcomes. |
| <p><i>Instructional Methods That Spark Curiosity (Part 2)</i></p> <p>Expert Interview</p> <p>11:30 min</p> | <p>Jon R. Star, Ph.D. Harvard University</p> | <ul style="list-style-type: none"> • Dr. Star discusses strategies to spark students' curiosity. • Teachers can try to make connections between the math and science in class and how it is used out in the world. They can also integrate music and other elements that students may be able to relate to. • District administrators and principals can help synthesize information for teachers about good resources to draw from. • Additional planning time and shared prep periods can help teachers strategize and collaborate with each other. Teachers should be given the opportunity to observe other teachers in action. |

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| Title/Media Type | Who | Description | Sample Material |
| <i>Using Project-Based Learning</i> Slideshow w/o audio (8 slides) | Daniel Brown Hillcrest High School Dallas, TX | <ul style="list-style-type: none"> • A high school physics teacher uses hands-on activities to engage students in project-based learning and help them better connect with science. • Students rotate roles within groups to make sure every student has performed all roles of scientific experiments. • Creating an environment in which girls and boys have an equal opportunity to succeed is a crucial part of classroom management—one strategy is to seat girls separately, so boys do not take over group activities. • When students actively collaborate with each other, they come away with a stronger grasp of the material. | No Sample Material |
| <i>Developing Girls' Interest in Science</i> Slideshow w/o audio (12 slides) | Clarke N. Johnsen Junior High School Tooele, UT | <ul style="list-style-type: none"> • Instruction that involves an interesting context, open-ended problem solving, and hands-on use of materials can help develop girls' interest in science. • Labs in science classrooms engage students & help them see themselves in scientist roles. • In some of the labs, students design their own experiments and decide on the measurement tools. • After-school math and science clubs provide great opportunities for hands-on science experience. | <i>Lesson Plan: Changing the Density of Bread</i> —A lesson plan that provides a hands-on opportunity to make predictions and experiment with a piece of bread to understand concepts related to mass, volume, and density. Junior high students acquire the skills of scientific investigation and explanation. Through the experiment, students learn that changing volume while not changing the mass will change the density of the bread. |

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| Title/Media Type | Who | Description | Sample Material |
| <i>Science Activities That Engage Girls</i> Video Interview 6:03 min | Donna Ward Camille Clegg-Patch Kelly Parks Cheryl Dearing Clarke N. Johnsen Junior High School Tooele, UT | <ul style="list-style-type: none"> 4 junior high science teachers discuss nontraditional instruction and innovative project ideas. Girls learn to connect science concepts to everyday experiences and topics of interest to them. Nontraditional teaching methods can be useful since students sometimes struggle with informational text. Throwing a Frisbee is a physics demonstration; dying Barbie's hair is a chemistry experiment. | No Sample Material |
| <i>Strategies for Engaging Students</i> Video Interview 7:46 min | Daniel Brown Hillcrest High School Dallas, TX | <ul style="list-style-type: none"> A high school physics teacher describes strategies to capture students' immediate interest in physics. Young men often have more physical intuition than young women in high school physics. Lab lessons help provide young women with the experience they were lacking so far. Students work in gender-segregated groups to avoid the influence of stereotypical gender roles on students' experience in physics labs. It is very helpful to encourage students to teach their peers. Students doing tutoring during class time are internalizing the material on a deeper level. Students being tutored get immediate assistance when the teacher is busy helping other work groups. | No Sample Material |
| <i>Science in Motion</i> Classroom Video 6:12 min | Daniel Brown Hillcrest High School Dallas, TX | <ul style="list-style-type: none"> A high school physics teacher presents a pre-AP physics lesson about conservation of momentum. Students learn how to interpret data plotted by a computer program. The lab lesson ends with a discussion of what students learned, including good questions raised by students during the lab time. | <i>Lab Lesson Plan: Conservation of Momentum</i> —Student handouts for a Pre-AP physics hands-on lab experiment using cars to learn about types of collisions and conservation of momentum. |

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| Title/Media Type | Who | Description | Sample Material |
| | Clarke N. Johnsen Junior High School Tooele, UT | | <p><i>Sample Lesson Plan: Design Your Own Mall Store</i>—A student handout for a lesson on designing a store for a new mall. The aim is to promote students' visual and spatial thinking.</p> <p><i>Lesson Plan: Urban Legends Experiment and "Mythbusters" Extra Credit</i>—A small group activity that promotes scientific exploration by having students select 3 myths they would like to explore and develop experiments to prove or disprove each myth. They make hypotheses, design a research plan, identify materials and measurement tools, and create step-by-step instructions for the study methodology.</p> |
| <p><i>Careers in Science</i> Video Interview 3:25 min</p> | Camille Clegg-Patch Clarke N. Johnsen Junior High School Tooele, UT | <ul style="list-style-type: none"> • A science teacher describes students' excitement about what they saw at an engineering fair. This led to an assignment to create a brochure about the education needed for a specific career in math, science, or engineering. • The assignment motivated the girls to pick a career and apply themselves to the schooling necessary, regardless of the obstacles they would face. • The teacher emphasizes that the students can become any of the things they had based their brochures on. It would just take effort on their part—the choice was up to them. | <p><i>Career Brochure: Guide to Being a Psychologist</i>—Student-created brochure on being a psychologist, including basic facts & trivia.</p> <p><i>Career Brochure: Robotic Engineering</i>—Student-created brochure with basic information on becoming a robotic engineer.</p> <p><i>Career Brochure: Environmental Engineering</i>—Student-created brochure that describes the job, education requirements, and appeal of becoming an environmental engineer.</p> <p><i>Career Brochure: Telecommunications Technician</i>—A student explores the job duties, education required, and average salary of a telecommunications technician.</p> |

| DO WHAT WORKS | |
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| Tool | Description |
| <i>Learning Together About Sparking Curiosity</i> | An in-service protocol for teachers to learn strategies for sparking initial curiosity and fostering long-term interest in math and science. |
| <i>Teacher Self-Reflection: Strategies for Sparking Curiosity</i> | An evaluation form to guide teachers' self-reflection on instructional strategies for sparking initial curiosity and fostering long-term interest in math and science. |
| <i>Conducting a School Assessment: Sparking Curiosity</i> | An assessment worksheet to examine the degree of school support for sparking interest in math and science, and to identify areas for improvement. |
| <i>Designing Math and Science Lessons to Spark Girls' Curiosity</i> | A tool with tips to organize the integration of fun math and science activities for girls into the math/science curriculum, and to connect students to additional opportunities in math and science. |
| Planning Templates | Comprehensive planning templates for working with state education agencies, districts, and schools on addressing ways to spark curiosity. |

Topic: *Encouraging Girls in Math and Science (GMS)*

Practice: *Teach students spatial skills such as how to visualize and manipulate forms and shapes. (Teaching Spatial Skills)*

PRACTICE SUMMARY

| Title/Media Type | Description |
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| <i>Teaching Spatial Skills to Girls</i> Multimedia Overview 5:00 min | <ul style="list-style-type: none"> Boys regularly outperform girls on tests of spatial skills (especially rotating 3-D objects). Spatial skills are important in the math and science fields, many professional careers, and everyday life. These skills can be taught. Instructional techniques range from encouraging young girls to play with building toys to providing specific instruction in the mental rotation of images. |

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| Title/Media Type | Who | Description |
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| <i>3-D Spatial Skills for Secondary Students (Part 1)</i> Expert Interview 11:42 min | Sheryl Sorby, Ph.D. Michigan Technological University | <ul style="list-style-type: none"> Dr. Sorby defines spatial skills and describes how they are used in everyday living, K–12 education, and professional careers. There are significant differences in the ability to visualize rotating objects between genders; all students improve through training and practice. Research shows strong links between spatial skills and math performance, spatial skills and success in different careers, and spatial skills training and university-level retention rates for female students. One of the biggest reasons to help girls develop spatial skills is the confidence this will give them when they get further on in technology and math courses. |
| <i>3-D Spatial Skills for Secondary Students (Part 2)</i> Expert Interview 4:48 min | Sheryl Sorby, Ph.D. Michigan Technological University | <ul style="list-style-type: none"> In teaching spatial skills, Dr. Sorby recommends having students use computer models and draw sketches in combination since it is more effective than just relying on the computer. Using props can help students visualize the process. |

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| Title/Media Type | Who | Description | Sample Material |
| <i>Spatial Skills in High School Science and Math</i> Audio Interview 6:26 min | Lisa Raffaelli Jeffers High School Painesdale, MI | <ul style="list-style-type: none"> A high school math teacher describes how she integrates spatial skills training into geometry class. Some girls show strong gains in spatial skills, indicating that they came in with strong math skills but had not had the opportunity to develop their spatial skills. | <i>Isometric Dot Paper for Drawing 3-D Figures</i> —A blank isometric dot paper used to draw 3-D figure drawings. Sample student work shows how they used little snap cubes to create a model of a 3-D figure, then used the isometric dot paper to draw how the figure appears after rotation. <i>Isometric Grid Paper for Drawing 3-D Figures</i> —A blank isometric grid paper used as an alternative drawing tool to the isometric dot paper. |
| <i>Hands-On Activities for 3-D Spatial Skills (Part 1)</i> Classroom Video 11:00 min | Sheryl Sorby, Ph.D. Michigan Technological University | <ul style="list-style-type: none"> A demonstration of 3-D drawing skills. Spatial skills enable you to visualize what something looks like if you rotate it in space. To develop 3-D spatial skills, students should learn to sketch 3-D objects on 2-D paper. Teaching students spatial skills can be done by having them draw an isometric view of an object on isometric grid paper. Repetition is very helpful in allowing the students to grasp the concept. | No Sample Material |
| <i>Hands-On Activities for 3-D Spatial Skills (Part 2)</i> Classroom Video 6:28 min | Sheryl Sorby, Ph.D. Michigan Technological University | <ul style="list-style-type: none"> An important component of spatial skills is the ability to mentally rotate an object. Teachers can help students gain this ability by having them start by visualizing an object rotating around each of the three axes one at a time. To help students remember which positive and negative rotation, teachers can use the “right hand rule,” explaining that direction their fingers curl relative to their thumb is positive. | No Sample Material |



| DO WHAT WORKS | |
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| Tool | Description |
| <i>Learning Together About Providing Spatial Skills Training</i> | An in-service protocol for teachers to learn why and how to teach students spatial skills. |
| <i>Spatial Skills Training Lesson Planner</i> | A planning tool to help teachers explore ideas for spatial skills training in the classroom. |
| <i>Teacher Self-Reflection: Spatial Skills Training</i> | An assessment tool to guide teachers' self-reflection on instructional strategies for teaching spatial skills. |
| Planning Templates | Comprehensive planning templates for working with state education agencies, districts, and schools on addressing teaching spatial skills. |